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MOURNING DOVE STATUS REPORT

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UNITED STATES DEPARTMENT OF THE INTERIOR
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Special Scientific Report — Wildlife No. 132

UNITED STATES DEPARTMENT OF THE INTERIOR, WALTER J. HICKEL, *SECRETARY*
Leslie L. Glasgow, *Assistant Secretary for Fish and Wildlife and Parks*
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MOURNING DOVE STATUS REPORT, 1969

Compiled by

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Division of Wildlife Research



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ABSTRACT

U.S. mourning dove population indexes declined from 1968 to 1969 by 2 percent in the Eastern Management Unit and 8 percent in the Central Management Unit, but remained unchanged in the Western Management Unit. The changes were not statistically significant. The 1969 indexes were the lowest in the 11-year period 1959-69 and were below the 10-year means, 1959-69, by 8 percent in the Eastern Unit, 15 percent in the Central, and 21 percent in the Western. For the three units combined, the 1969 index was 5 percent below that for 1968 and 15 percent below the 10-year mean. Regression analyses of the call-count data for 1959-69 indicate a statistically significant downward trend in the dove breeding populations in all management units; mean rates of decline were 1 percent a year in the Eastern Unit, 3 percent a year in the Central, 4 percent a year in the Western, and 3 percent a year for the U.S. dove population as a whole.

The distribution of dove density is described by physiographic regions within management units. In 1969, the most extensive area of high dove density was in the eastern Great Plains and the Central Lowlands. Other important breeding areas were in the Upper Coastal Plain of the south Atlantic States, the Sonoran Desert of Arizona and California, and parts of the Colorado and Columbia Plateaus. Between 1968 and 1969, the greatest rate of population change occurred in these high-density regions.

INTRODUCTION

Management of mourning doves in the United States is essentially the regulation of hunting to achieve proper harvest. The Call-Count Survey, conducted annually since 1953 by Federal, State, and independent observers on more than 800 prescribed routes, provides population data on which wildlife administrators rely in setting annual regulations. This report describes the methods employed to obtain and analyze those data and presents the status of the 1969 mourning dove breeding population.

Two versions of the dove status report, one preliminary and one final, are prepared annually. In 1969 the preliminary version was mailed to members of the Dove Regulations Committee a week before the regulations meeting in June at Washington, D.C. This timely distribution was made possible by the promptness of cooperators who sent their data directly to the Migratory Bird Populations Station immediately after completion of their surveys. The present report is the final version and contains additional survey data received too late for use in the preliminary version. As is customary, it will be distributed to all cooperators and will be available to interested organizations and individuals.

Basic data gathering and analyzing procedures used in this report were the same as those used in 1968 (Ruos and MacDonald, 1970).

PROCEDURE

The Call-Count Survey

Field studies have demonstrated the feasibility of the Call-Count Survey as a method for detecting annual changes in mourning dove breeding populations (Foote and Peters, 1952). Since 1953, these surveys have been conducted throughout the United States over a system of more than 800 established routes. Each call-count route has twenty 3-minute listening stations spaced at 1-mile intervals, usually on lightly traveled secondary roads.

Each route is checked once between May 20 and June 10. Intensive studies in the eastern United States (Foote and Peters, 1952) indicated that dove calling is relatively stable during this period. Call-count surveys are not made when wind velocities exceed 12 miles per hour or when it is raining.

Records are kept of all doves seen or heard calling along the routes. The numbers heard calling during the 3-minute listening periods are totaled for each route to provide the data for determining the population index. The numbers of calls per dove and of doves seen are not currently used in the index calculation, but they are recorded. A detailed analysis of these and other pertinent data from past call counts is currently under study by the Migratory Bird Populations Station.

Studies by Frankel and Baskett (1961) and Jackson and Baskett (1964) have shown that unmated males call at a greater rate than mated males. This suggests that the reliability of the annual call-count census is reduced by the variability in the ratio of mated to unmated males. However, Wight (1964) observed that variations in the ratio of mated to unmated males, where the adult sex ratio approached equality, did not significantly alter the reliability of the dove call count for measuring annual trends of breeding mourning doves. Irby (1964) also found no evidence on his study area in Arizona that the numbers of unmated males materially affected call-count results.

Quality checks of field data

Survey reports were examined to determine circumstances affecting the accuracy with which the routes were run and the data recorded. Records for routes run under unacceptable conditions were not analyzed.

Reports on routes completed under the prescribed conditions but containing discrepancies or errors, or lacking data, were examined to ascertain whether parts were acceptable. If so, they were used in analyses for which they were applicable. Where there was a change in observers on a route from one year to the next, the data were examined to determine whether an unexpected population change was apparent. When such differences exceeded those of the prescribed limits, they were attributed to differences in observers, and the data were not used in the current analysis.

Randomization of call-count routes

The original call-count routes (established between 1951 and 1956, and hereafter designated "management routes") were in many instances selected in areas of high-density dove populations and were not representative of populations over entire States or management units.

Randomly located routes were first employed in seven southeastern States in 1957 (Foote, Peters, and Finkner, 1958). A comparative study of the random and management route data from these States confirmed earlier assumptions that a revision of the nationwide call-count survey routes should be undertaken if representative dove population indexes were to be obtained. This recommendation prompted the gradual selection and establishment of the 868 randomly located call-count routes now employed in 44 States. Selection of random routes in the remaining four States of Maine, New Hampshire, Rhode Island, and Vermont (now represented by a total of 11 management routes) was completed prior to the 1969 survey. All States, except Maine, have provided random data for 1 or more years. In 1970, data from Maine also are expected to come from random routes.

Both types of routes were run during the year of transition from management to random routes. This procedure permitted a direct comparison of data (Foote, Peters, and Finkner, 1958). Since 1967, randomized data have been obtained for 44 States for 2 or more years.

Physiographic stratification of call-count routes

Biologists recognize the limitation of sampling wildlife populations by political units. Census data collected and analyzed by ecological divisions represent better statistical design and could be expected to provide more precise information with the same effort.

An ecological sampling design for the collection of dove population data, using physiographic regions as the basis for stratification, was suggested by Foote, Peters, and Finkner (1958). The 78 regions designated in this report (fig. 1) are based essentially on a map entitled "Physical Divisions of the United States" prepared by Fenneman (1931). The boundaries of these divisions were modified in several instances after examination of field data and more recent ecological studies

Breeding Density Index

The Breeding Density Index (BDI) is an indicator of the number of doves per unit of area and is derived from the average number of calling doves per route. To obtain as accurate an average as possible for derivation of this index, the call-count data from each stratum in each State are weighted according to the land areas they represent.

Before 1966, the BDI for each State represented the average number of birds heard calling per route within that State, thus weighting all routes equally. The State averages were then weighted in proportion to the estimated area of dove habitat in each State of a management unit (fig. 2) to provide a Breeding Population Index for each unit (U.S. Bureau of Sport Fisheries and Wildlife, 1957).

Beginning with the 1966 survey analysis, weighting factors based on physiographic regions were used for calculating BDI values in States which had been "randomized" for 2 or more years. The average number of doves heard calling per route in each region within a State was weighted by the percentage of the total land area in the State occupied by that region.

Calculation of management unit BDI's since 1965 has involved two similar procedures as a result of a computer program change. In 1966 and 1967, indexes were determined for each management unit by weighting each State's BDI by the percentage of the total land area occupied by that State in the management unit. When a region within a State was not represented by a BDI, that region assumed the mean of the other regions weighted by land area in that State. In 1968 and 1969, management unit BDI's were derived directly from State physiographic region BDI's. When a region within a State was not represented by a BDI, that region assumed the weighted management unit mean. Minor differences between these procedures are evident only when physiographic regions within States are not represented by comparable routes.

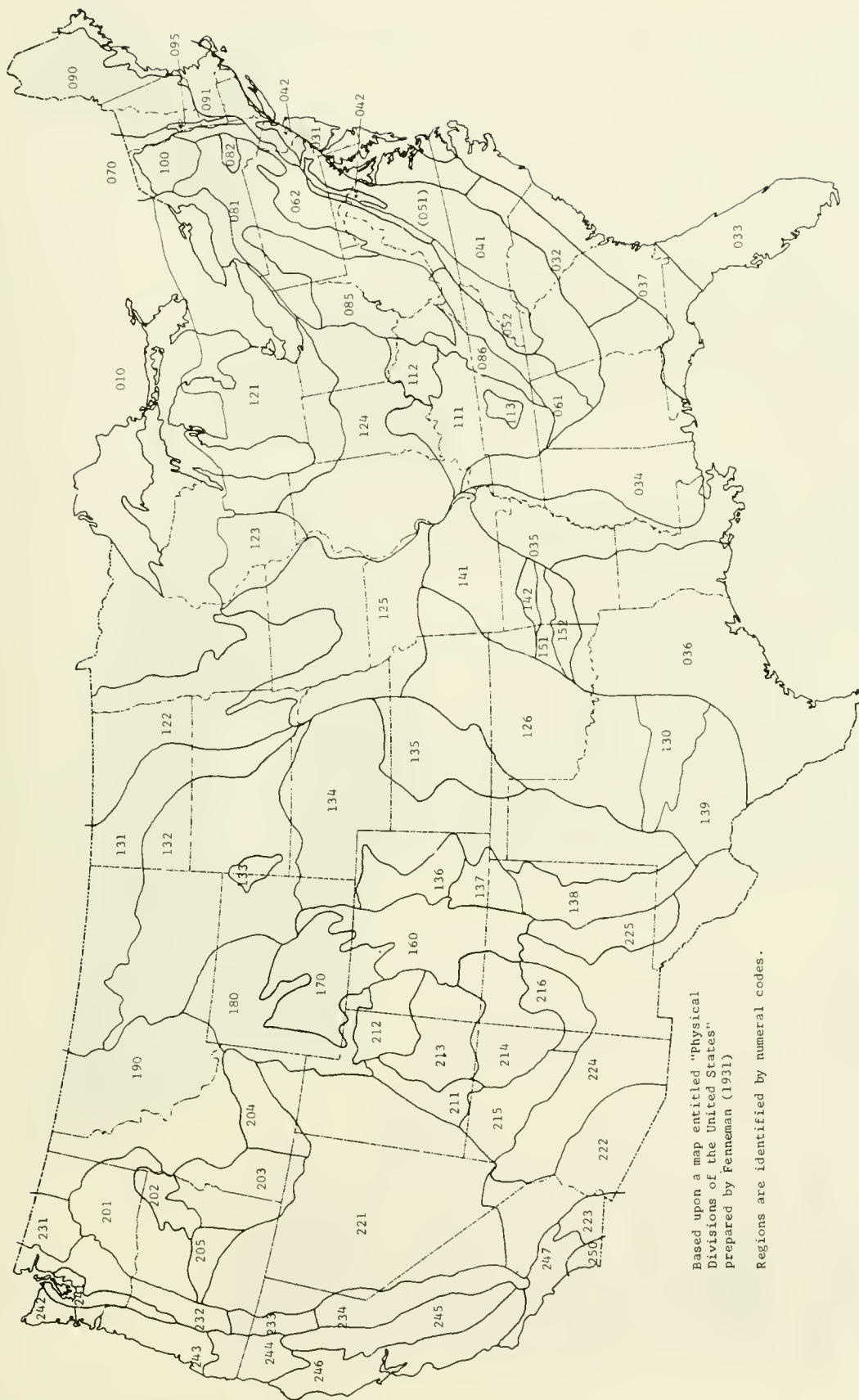


Figure 1.--Physiographic regions used in analysis of mourning dove population data, 1967-69.
See page 6 for strata codes.

Physiographic Regions Used in Analysis of Mourning Dove Population Data, 1968 [Modified after Fenneman (1931)]

<u>Description</u>	<u>Stratum Code</u>	<u>Description</u>	<u>Stratum Code</u>	<u>Description</u>	<u>Stratum Code</u>
Laurentian Upland Division		Interior Plains Division		Intermontane Plateaus Division	
Superior Upland Province	010	Interior Low Plateaus Province		Columbia Plateaus Province	
Atlantic Plain Division		Highland Rim section	111	Walla Walla Plateau	201
Coastal Plain Province		Lexington Plain	112	Blue Mountain section	202
Embayed section	031	Nashville Basin	113	Payette section	203
Upper Coastal Plain	032	Central Lowland Province		Snake River Plain	204
Floridian section	033	Eastern lake section	121	Harney section	205
East Gulf Coastal Plain	034	Western lake section	122	Colorado Plateaus Province	
Mississippi Alluvial Plain	035	Wisconsin Driftless section	123	High Plateaus of Utah	211
West Gulf Coastal Plain	036	Till Plains	124	Uinta Basin	212
Lower Coastal Plain	037	Dissected Till Plains	125	Canyon Lands	213
		Osage Plains	126	Navajo section	214
Appalachian Highlands Division		Great Plains Province		Grand Canyon section	215
Piedmont Province		Central Texas section	130	Datil section	216
Piedmont Uplands	041	Missouri Plateau, glaciated	131	Basin and Range Province	
Piedmont Lowlands	042	Missouri Plateau, unglaciated	132	Great Basin	221
Blue Ridge Province	051	Black Hills	133	Sonoran Desert	222
Northern section	052	High Plains	134	Salton Trough	223
Southern section		Plains Border	135	Mexican Highland	224
Valley and Ridge Province		Colorado Piedmont	136	Sacramento section	225
Tennessee section	061	Raton section	137		
Middle and Hudson Valley section	062	Pecos Valley	138	Pacific Mountain Division	
St. Lawrence Valley Province		Edwards Plateau	139	Cascade Sierra Mountains Province	
Champlain and Northern section	070	Interior Highlands Division		Northern Cascade Mountains	231
Appalachian Plateaus Province		Ozark Plateaus Province		Middle Cascade Mountains	232
Mohawk and Allegheny section	081	Springfield-Salem plateaus	141	Southern Cascade Mountains	233
Catskill section	082	Boston "Mountains"	142	Sierra Nevada	234
Kanawha section	085	Ouachita Province		Pacific Border Province	
Cumberland section	086	Arkansas Valley	151	Puget Trough	241
New England Province	090	Ouachita Mountains	152	Olympic Mountains	242
Northern New England section	091	Rocky Mountain Division		Oregon Coast Range	243
Southern New England section	095	Southern Rocky Mountains Province	160	Klamath Mountains	244
Taconic section	100	Wyoming Basin Province	170	California Trough	245
Adirondack Province		Middle Rocky Mountains Province	180	California Coast Ranges	246
		Northern Rocky Mountains Province	190	Los Angeles Ranges	247
				Lower Californian Province	250

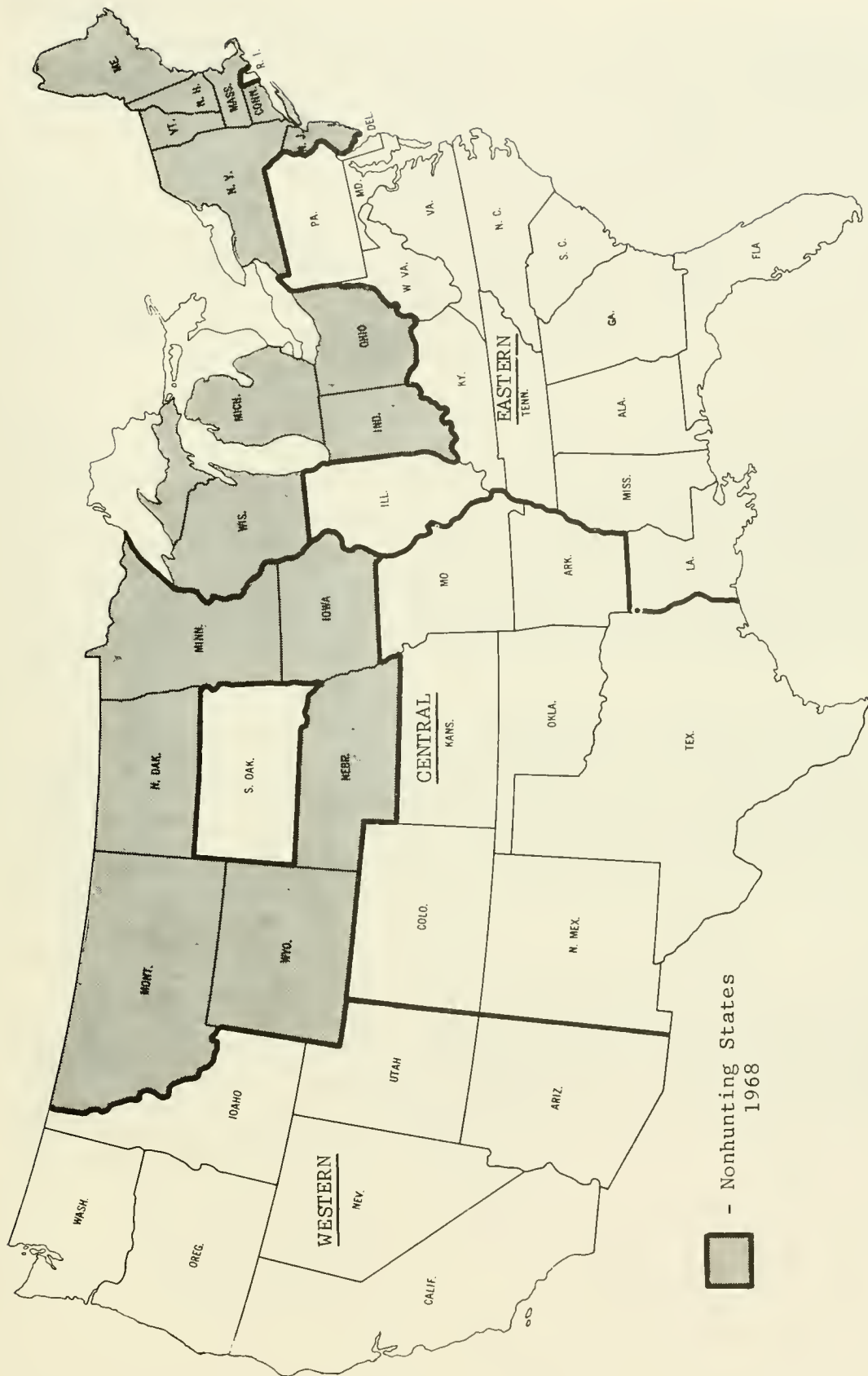


Figure 2.--Mourning dove management units

Only four States (Maine, New Hampshire, Rhode Island, and Vermont) did not provide randomized data in both 1968 and 1969. Management route data from these States were not weighted and were not included in the management unit averages. Consequently, comparable data for 1968 and 1969 BDI values are given for only 44 States.

Determination of short-term population changes, 1968 to 1969

Changes in the size of mourning dove breeding populations between 1968 and 1969 are indicated by data from 606 comparable routes run in both years. The average appropriately weighted BDI values for each year are presented for each State and management unit (appendix table A1). Differences in these BDI values, expressed as percent change, determined the magnitude of changes in the breeding population.

Determination of long-term population trends, 1959 to 1969

Short-term (year-to-year) population changes are based, as indicated, on data from comparable routes only. Since the composition of these comparable routes changes with each 2-year comparison, a Base Year Index (BYI) has been chosen for each State. Long-term trends have been shown by applying the percent change from year to year to this index. Before 1967, the BYI was generally the first year that the State's call-count routes were randomized. This method of selection had an advantage over the selection of a single year for all States.

In order to provide a more uniform basis for evaluation of long-term trends, the BYI for all States has been selected as the mean of the comparable 1966 and 1967 routes, as presented in the Mourning Dove Status Report, 1967 (Ruos and MacDonald, 1968). This BYI is thought to provide a meaningful refinement over the previous method. Not only are two "random-route" years averaged to reduce the influence of a possible atypical year, but the choice of a uniform BYI period for all States reduces possible bias in overweighting a State by the selection of a BYI in a peak year.

As in the past, the BYI value for each State for each year is weighted to provide management unit values. This weighting is based upon differences in land area among States. The land area values and the BDI values for States and management units by year are presented in appendix table A2.

Computer analysis of dove call-count data

Through the efforts of the North Carolina Institute of Statistics, University of North Carolina, and with the support of the Southeastern Association of Game and Fish Commissioners, an improved computer program was made available for the analysis of the 1968 and 1969 call-count data. This program provides properly weighted State and management unit averages. It yields the mean difference, the standard error of the mean difference, and the level of significance of the change for each State and management unit. This program also provides a summary of data by physiographic region irrespective of State boundaries, thus allowing analysis of population distribution by physiographic region.

Statistical evaluation of data, 1959 to 1969

The procedures employed on the annual call-count survey were originally designed to detect a 20-percent change in the population index (BDI) within a management unit at the 95-percent level of significance (Foote, 1959). Analysis of the 1968 and 1969 data, however, revealed that observed differences of 7.5, 9.8, and 14.2 percent between years within the three management units would represent statistically significant changes in population. For the entire country, an observed difference of 6.3 percent in the BDI between 1968 and 1969 would be significant. Although the survey was not designed to detect a statistically significant change in the BDI between years within States or physiographic regions, data from these areas were also analyzed for statistical significance.

Long-term (1959-69) BYI's for all management units and the combined hunting or nonhunting States of these units were examined to determine whether significant trends were present. Data from each unit were analyzed using six regression models. The linear regression model was used in each instance in which there was statistical significance even though a slight curvilinear relation was indicated by several analyses.

Determination of population distribution, 1968 and 1969

The density-distribution of doves within a management unit has been determined from a study of average physiographic region BDI values. These data for 1969 have been assigned to one of five density classes, as shown in figure 3. Changes in BDI values greater than 10 percent between 1968 and 1969 within a physiographic region also were determined (fig. 4). In all instances, only those BDI's obtained from comparable routes in both years were examined.

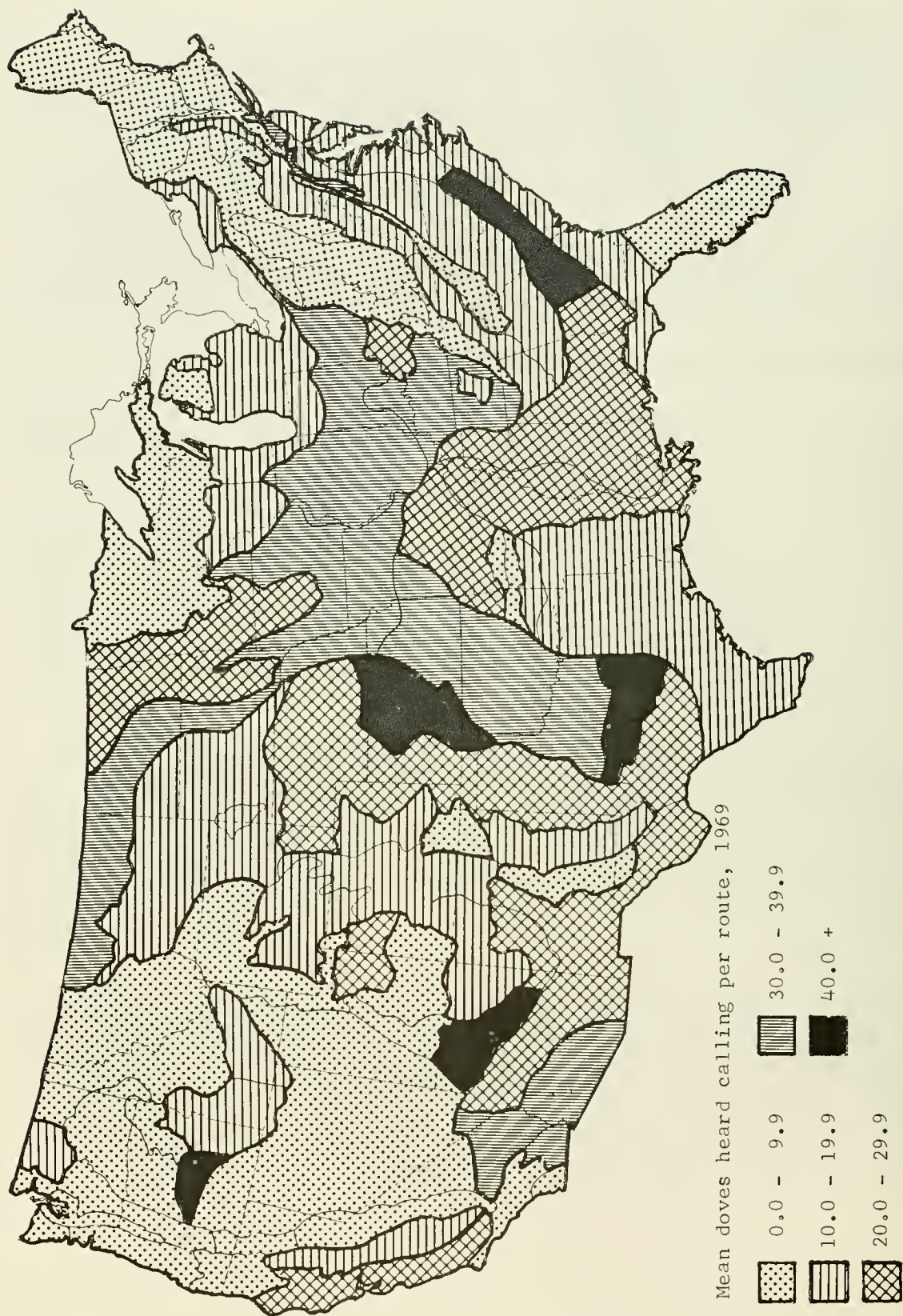


Figure 3.--Relative densities of breeding mourning dove populations by physiographic region, 1969.

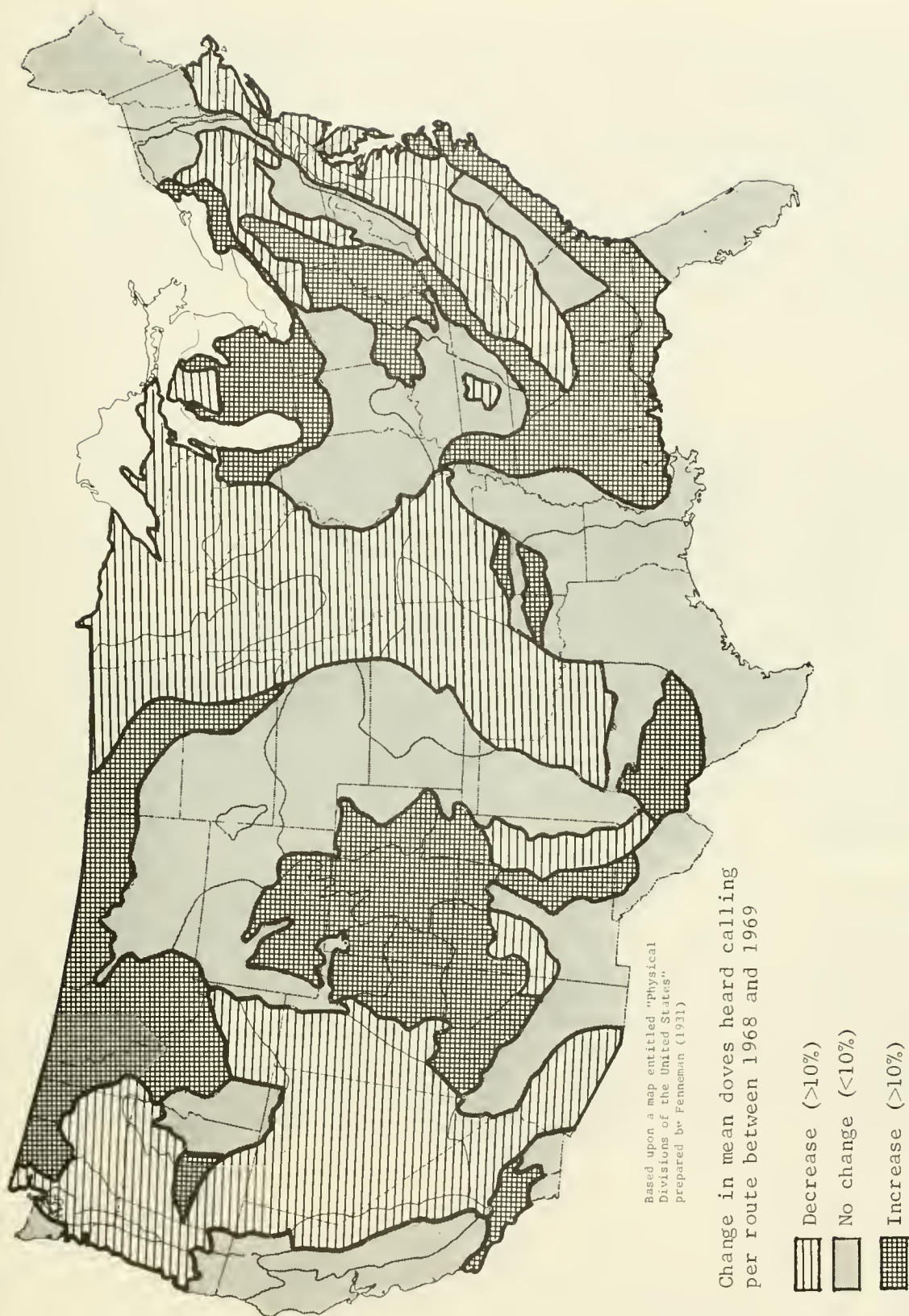


Figure 4.--Changes in densities of breeding mourning doves by physiographic region between 1968 and 1969.

Further study was made to identify the major high-density dove production areas by physiographic region within management units. High-density areas included those regions with the highest BDI's most nearly totaling 50 percent of the unit's population. This was accomplished by ranking all BDI's in descending order. These values were then converted to Breeding Population Indexes (BPI's) by multiplying the BDI by its represented land-area value. The sum of the ranked BPI's most nearly representing 50 percent of a unit's population determined those regions included in the high-density areas. The importance of each of 16 regions with the highest BDI's is shown in appendix table A3; the high-density areas are further identified in figures 5 and 6.

FINDINGS

Current dove populations, as indicated by the call-count survey, are at their lowest levels for the 11-year period, 1959-69. All 1969 management unit population indexes are well below their preceding 10-year means. Further, a statistically significant downward population trend was found in each management unit; the Central and Western Units showed the greatest rates of decline.

From 1968 to 1969, the Central Unit index declined 7.6 percent, while population levels remained relatively stable in the other units. The greatest rate of change occurred in the high-density areas of all management units. Dove populations in the nonhunting States of the Central Unit were found to be declining at the greatest rate of any subunit in the country. Noteworthy is the observation that the Eastern Unit's nonhunting States comprise the only subunit represented by an increasing dove population. Further study of these data is presented by management unit.

Status of the United States dove population

1968 to 1969 populations.--Figure 3 shows the relative densities of breeding doves by physiographic region in 1969. High-density areas in the United States are identified in appendix table A3 and figure 5. In 1969, these areas represented 50 percent of the population and 28 percent of the land area. The mean BDI of the high-density areas was 2.6 times that of the low-density mean (34.5 doves heard per route compared with 13.4 doves heard). The most extensive area of high dove density was in the midcontinent, especially in the eastern Great Plains

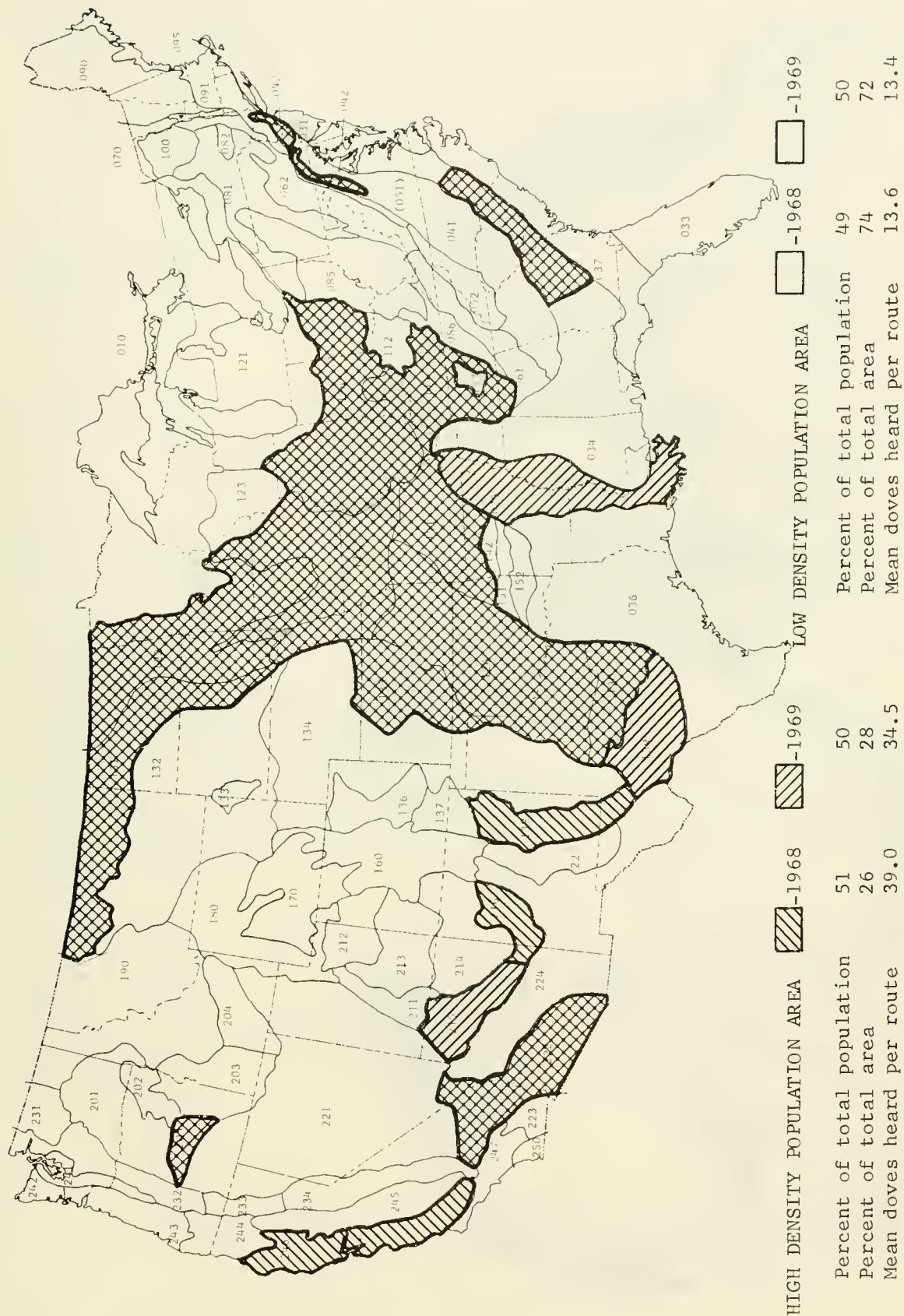
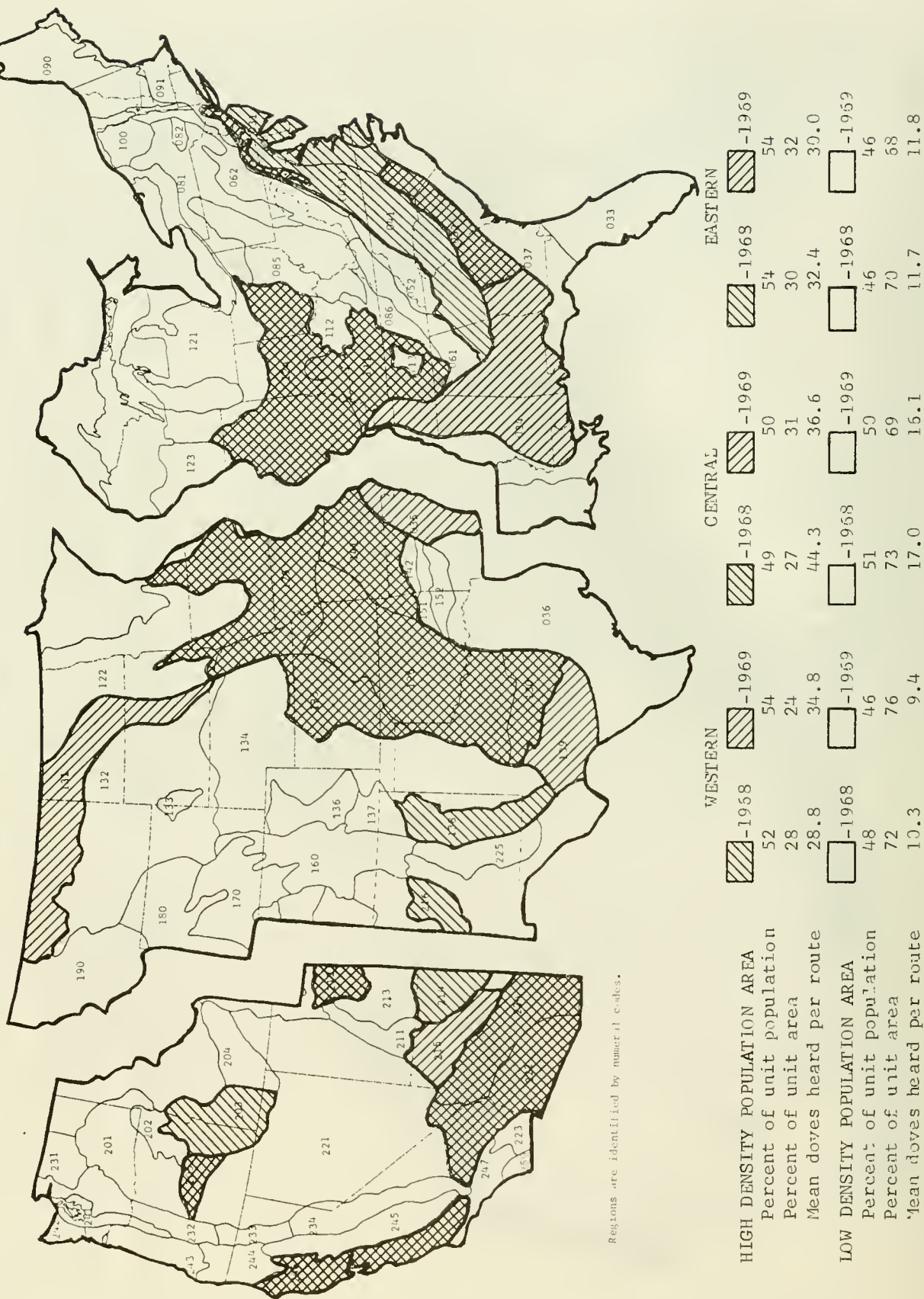


Figure 5.--High density dove breeding population areas by physiographic region, 1968, 1969.

Figure 6.--High density breeding populations by management unit and physiographic region, 1968, 1969.



and Central Lowlands. Other important breeding population areas were observed in the Upper Coastal Plain of Georgia and the Carolinas, the Sonoran Desert of Arizona and California, the Grand Canyon of Arizona, and part of the Columbia Plateau in Oregon.

The United States BDI declined 4.7 percent from 20.3 doves heard per route in 1968 to 19.3 doves heard per route in 1969 (appendix table A1). During the same period, the mean high-density population BDI declined 11.6 percent from 39.0 doves to 34.5 doves per route, while the low-density area BDI remained relatively stable, down 0.9 percent from 13.6 doves to 13.4 doves per route. The BDI for the combined hunting States decreased 3.9 percent from 20.1 doves per route in 1968 to 19.3 doves in 1969; whereas the combined nonhunting States declined 6.4 percent from 20.7 to 19.3 doves per route (appendix table A1).

Changes in the BDI greater than 10 percent between 1968 and 1969 by physiographic region are shown in figure 4. The most extensive areas of increase were noted in the Rocky Mountains and Colorado Plateau, Lower and East Gulf Coastal Plains, and sections of the western Appalachian Plateau and Central Lowlands. Three broad areas of decrease were observed: the Great Basin and Sonoran Desert, the western Central Lowlands, and the eastern Appalachians and adjacent Piedmont. No important shift was noted in high-density population areas between 1968 and 1969 (appendix table A3 and fig. 5). In 1969, physiographic regions 035, 139, and 215 replaced regions 138, 216, and 246 as high-density areas.

Long-term trends, 1959 to 1969.--The 1969 BYI's for the United States, the combined hunting States, and the combined nonhunting States are the lowest observed for the 11-year period, 1959-1969 (appendix table A2). This is the third successive year of decline in BYI's (Ruos and MacDonald, 1970). The BYI's for these areas in 1969 are also well below the preceding 10-year means: United States, -14.7 percent; hunting States, -13.6 percent; and nonhunting States, -17.1 percent (appendix table A2).

Annual BYI's plotted in figures 7 and 8 reflect the general downward trend in BYI's since 1959. Linear regression analyses of these data (appendix table A4) are shown in figure 9. The BYI's declined at an average annual rate of 2.7 percent in the United States, 2.4 percent in the hunting States, and 3.3 percent in the nonhunting States. Thus, this study reveals a significant decline in U.S. populations between 1959 and 1969.

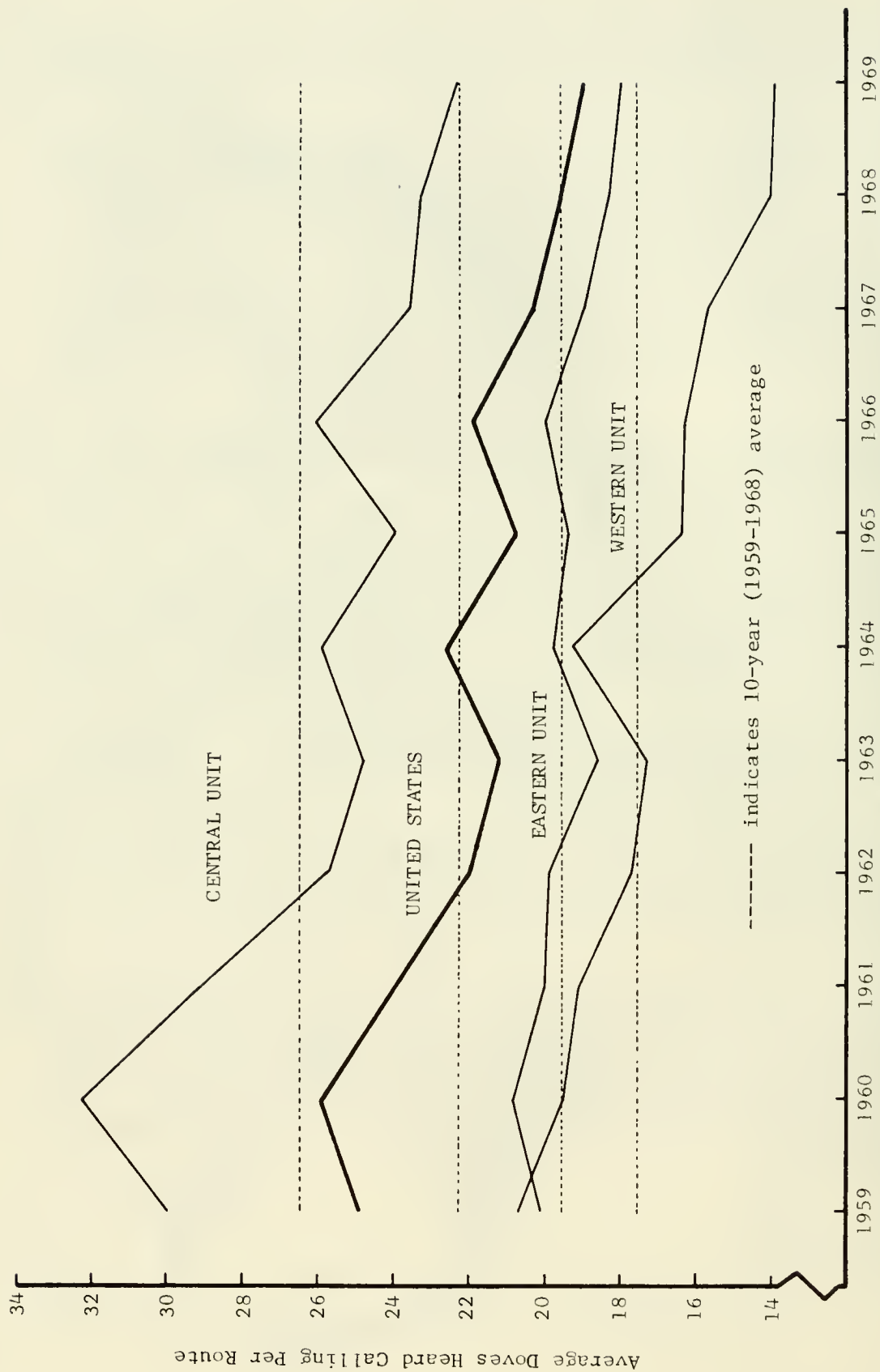


Figure 7.--Breeding mourning dove population indexes by management unit, 1959-1969.

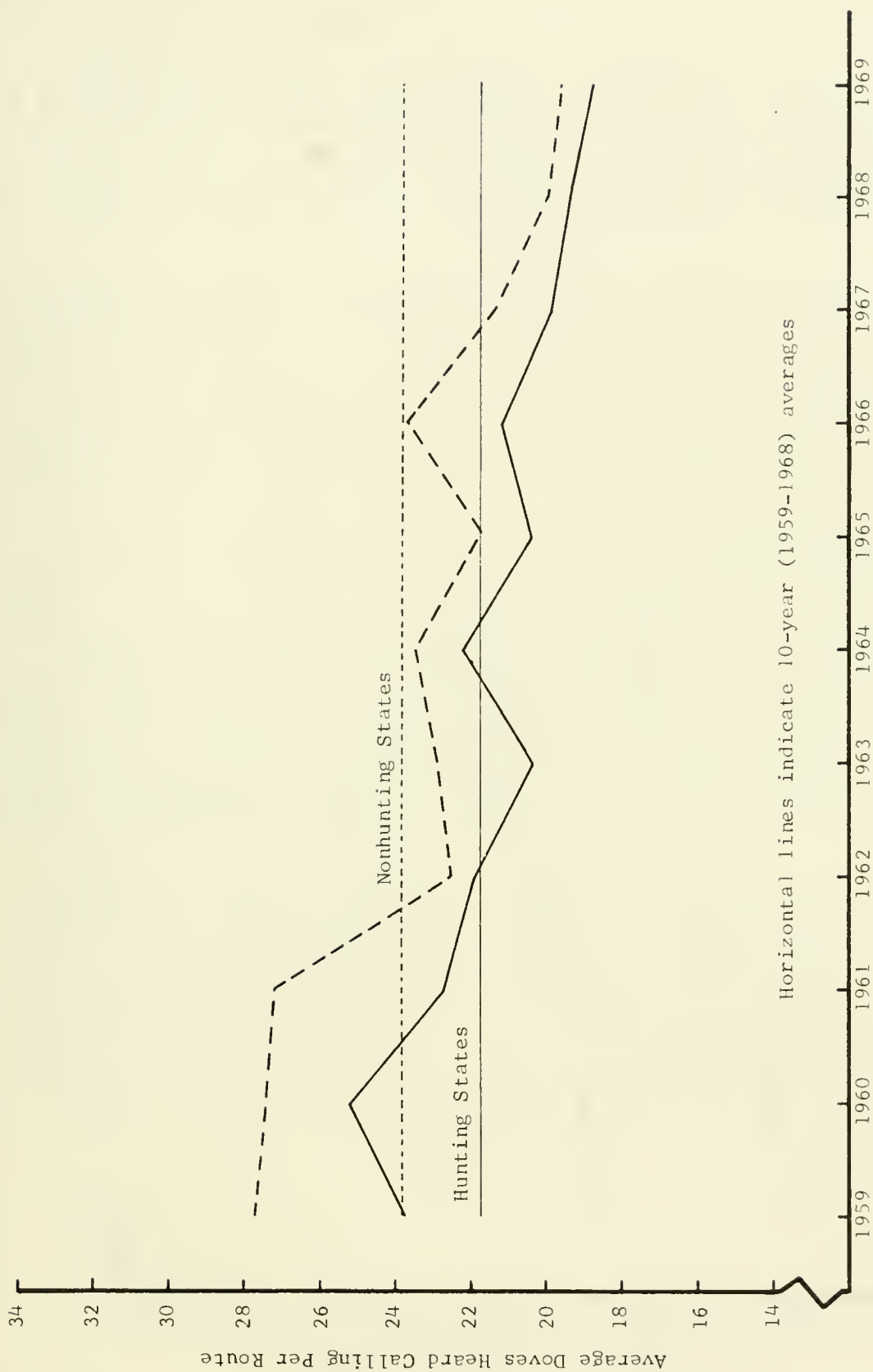


Figure 8.--Breeding mourning dove population indexes for the United States hunting and nonhunting States, 1959-1969

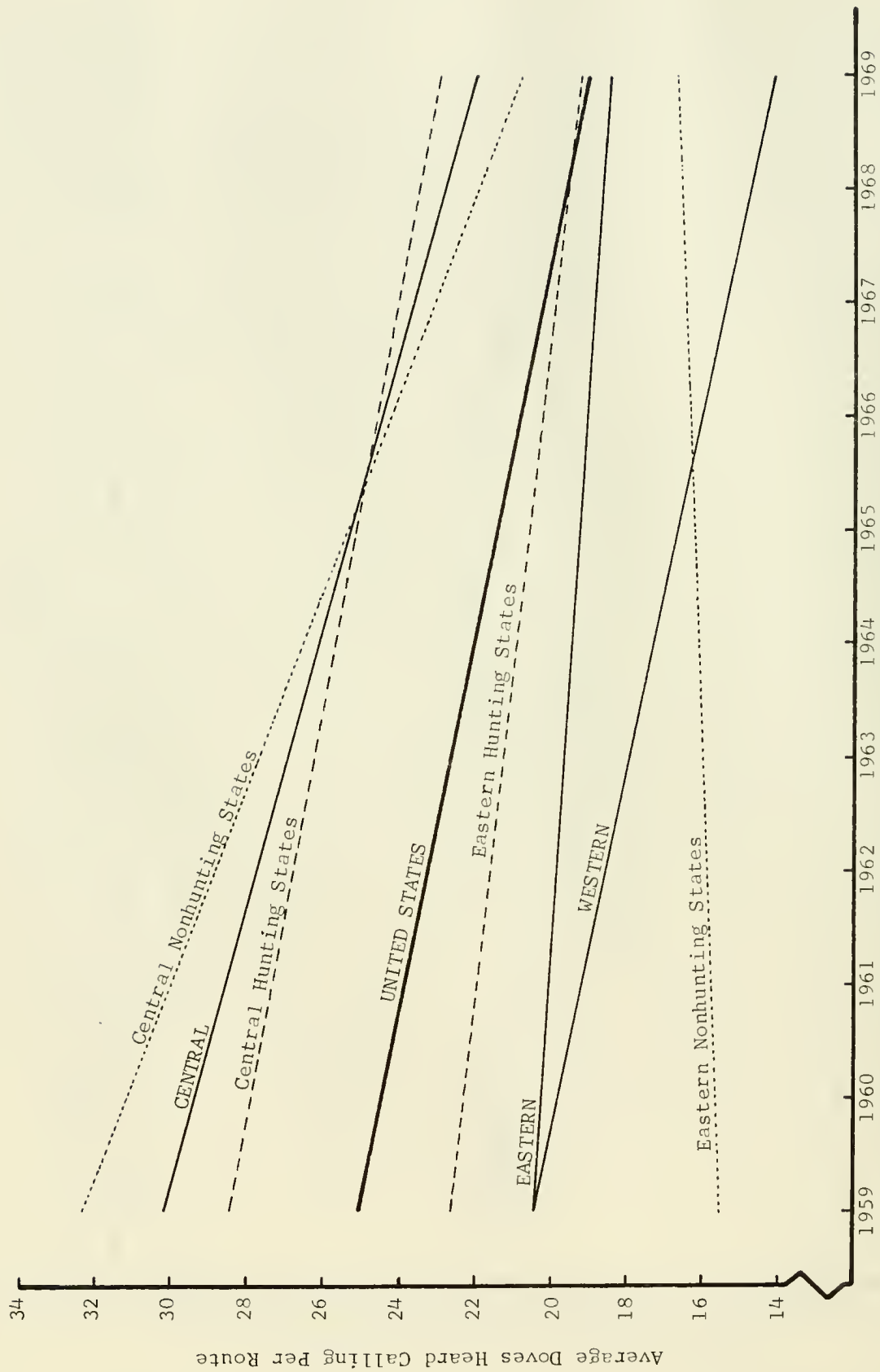


Figure 9.--Linear regression lines of mourning dove call-count data, 1959-1969

Status of the Eastern Management Unit population

1968 to 1969 populations.--In this Unit, high-density populations in 1969 are confined principally to the southern part of the Central Lowlands, and much of the Interior Low Plateaus and Atlantic Coastal Plain (fig. 6). These areas comprise 32 percent of the Unit land area and contain 54 percent of the Unit's population. The mean BDI of the high density population areas (30.0 doves per route) was 2 1/2 times as great as for the remaining areas (11.8 doves per route).

The Eastern Management Unit BDI declined 1.7 percent from 17.9 doves heard per route in 1968 to 17.6 doves heard per route in 1969 (appendix table A1). For these same years, the high-density area BDI declined 7.4 percent from 32.4 doves per route to 30.0 doves per route, while the low-density area increased slightly, 0.9 percent, from 11.7 to 11.8 doves per route. The BDI for the combined hunting States decreased 2.5 percent from 18.9 doves per route in 1968 to 18.4 doves per route in 1969. For the combined nonhunting States, the BDI increased 0.4 percent from 15.58 to 15.64 doves heard per route.

A southwestward shift in the high-density area occurred between 1968 and 1969, as evidenced by physiographic region 034 replacing regions 031 and 041 in 1969 (fig. 6 and appendix table A3).

Long-term trends, 1959 to 1969.--The 1969 BYI's for the entire Eastern Unit and the combined hunting States within it are the lowest for the 11-year period - the third successive year of decline (Ruos and MacDonald, 1970). Population indexes for these areas were 8.1 percent and 13.2 percent, respectively, below their preceding 10-year means. In contrast, the 1969 BYI for the combined nonhunting States was the second highest recorded, 7.1 percent above the preceding 10-year mean (appendix table A2 and fig. 10).

The BYI's for the Eastern Unit, the combined hunting and the combined nonhunting States, are indicated in appendix table A2 and figures 7 and 10. Regression analysis shows that the Eastern Unit population declined significantly between 1959 and 1969; the mean rate of decline was determined to be 1.0 percent per year (fig. 9). During the same period, the combined hunting States index declined significantly at an average annual rate of 1.6 percent. Although no significant trend was found for the nonhunting States, the index increased at an average rate of 0.7 percent per year.

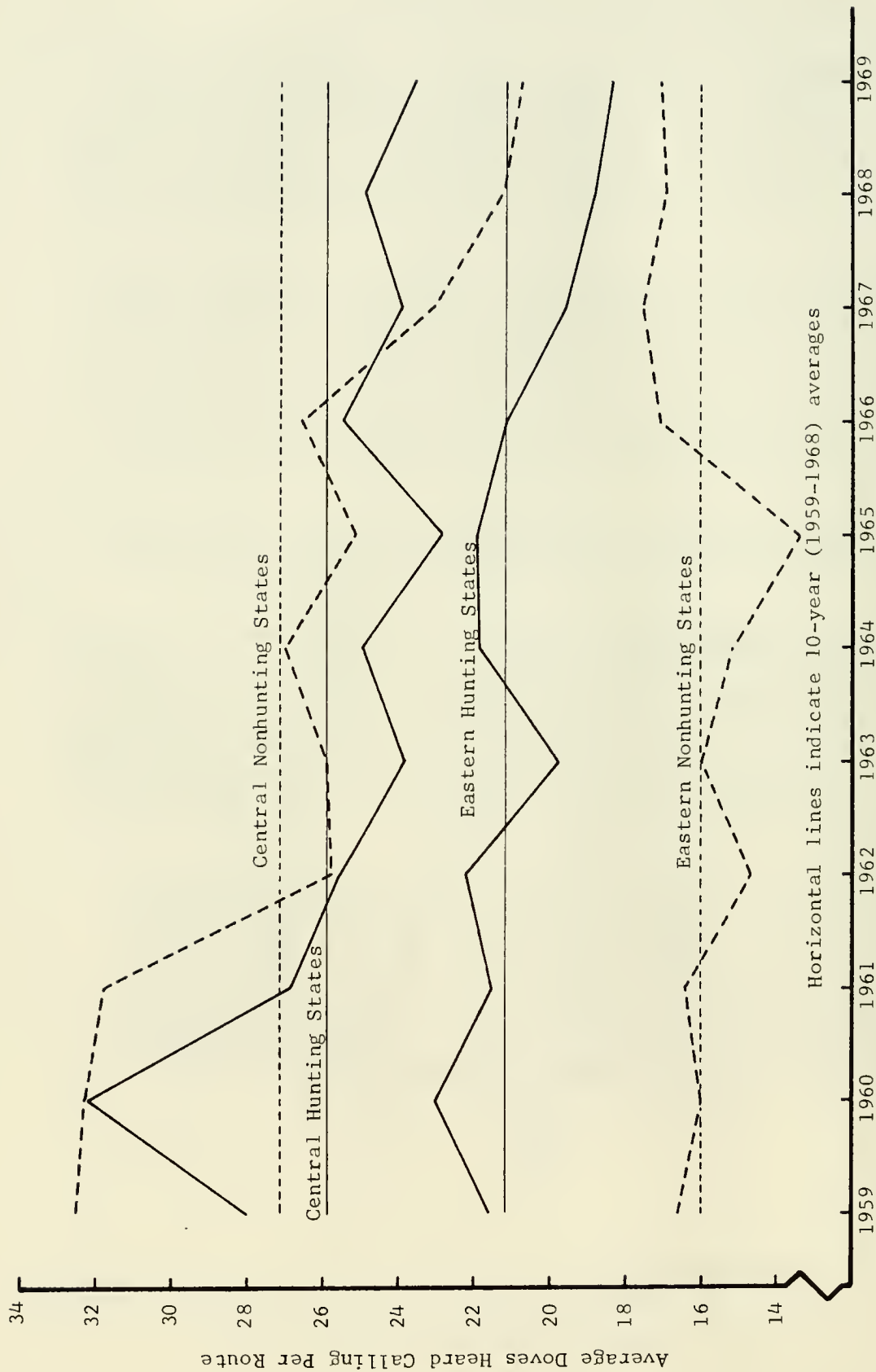


Figure 10.---Breeding mourning dove population indexes for the Eastern and Central Management Unit hunting and nonhunting States, 1959-1969

Status of the Central Management Unit population

1968 and 1969 populations.-- In 1969, high-density population areas were generally found in the eastern Great Plains and western Central Lowlands (fig. 6). This area of high density contained 50 percent of the Unit's population and 31 percent of the total land area. The mean BDI for the high-density area (36.6 doves per route) was 2.3 times that of the low-density area (16.1 doves per route).

The Central Management Unit BDI declined an average of 7.6 percent from 24.3 to 22.5 doves heard per route between 1968 and 1969 (appendix table A1). During the same period, the high-density area BDI declined 17.4 percent from 44.3 to 36.6 doves per route, while the low-density population area decreased 5.3 percent from 17.0 to 16.1 doves heard per route. The BDI for the combined hunting States decreased 7.0 percent from 25.4 to 23.6 doves heard per route between 1968 and 1969. For the combined nonhunting States, the BDI decreased 8.5 percent from 23.0 to 21.0 doves per route.^{1/}

Although no important shift in the high-density area occurred between 1968 and 1969, a geographical expansion of this area was evident in 1969 (fig. 6 and appendix table A3). Physiographic regions 035, 131, and 139 replaced regions 216 and 138 between 1968 and 1969.

Long-term trends, 1959 to 1969.--In 1969, the Central Unit, the combined hunting States, and the combined nonhunting States BYI's were the lowest for the 11-year period (appendix table A2). This is the third successive annual decline in the Central Unit and its nonhunting States (Ruos and MacDonald, 1970). Current population levels are well below the preceding 10-year means: Central Unit, -15.4 percent; combined hunting States, -8.9 percent; and combined nonhunting States, -23.2 percent (appendix table A2).

Annual BYI values shown in figures 7 and 10 reflect population levels between 1959 and 1969. Linear regression analyses of these data are presented in appendix table A4 and figure 9. A significant downward trend in dove populations occurred in each area. The annual rates of change in BYI's were calculated as follows: Central Unit, -3.1 percent; hunting States, -2.2 percent; and nonhunting States, -4.3 percent.

^{1/} South Dakota data included in nonhunting States subunit. Hunting was permitted in 1967 and 1968, but a change in subunit designation will not be made until 1970.

Status of the Western Management Unit population

1968 to 1969 populations.--In 1969, the high-density population areas in this Unit are in the California Coast Range, Sonoran Desert, Mexican Highland, and parts of the Columbia and Colorado Plateaus (fig. 6). These areas include 54 percent of the population and 24 percent of the Unit land area. The mean BDI of the high-density areas (34.8 doves per route) was 3.7 times that of the low-density areas (9.4 doves per route).

No significant change in the BDI occurred in the Western Management Unit between 1968 and 1969 as evidenced by a mean of 15.51 and 15.52 doves per route for these years (appendix table A1). During this same period, the high-density area BDI increased 20.8 percent from 28.8 to 34.8 doves heard per route, while the low-density area BDI declined 8.7 percent from 10.3 to 9.4 doves heard per route. All States within the Western Management Unit hunt mourning doves.

No major change in the geographical distribution of the high-density area between 1968 and 1969 was evident, although physiographic region 215 replaced regions 203 and 214 in 1969.

Long-term trends, 1959 to 1969.--Although the Western Unit population level did not change appreciably between 1968 and 1969, the current BYI is the lowest for the 11-year period (appendix table A2), and is 21.3 percent below the preceding 10-year mean.

BYI's for the Western Unit are presented in appendix table A2 and figure 7. They indicate a rather uniform rate of decline between 1959 and 1969, except for a notable increase in 1964. A linear regression analysis (appendix table A4) shows a mean rate of decline of 3.6 percent per year during the 11-year period.

Statistical significance of data

1968 to 1969.--No significant ($P < 0.05$) changes occurred in the BDI's of any management unit or in the combined hunting or nonhunting States of any unit between 1968 and 1969. Although not designed to detect population changes within States, the survey showed significant declines in North Carolina, Missouri, and Minnesota. In no State did the index increase significantly.

A study of physiographic region data obtained from the 1968 and 1969 call-count surveys was also made. As identified in figure 1, significant ($P < 0.05$) decreases in the BDI were observed in sections of the Atlantic Coastal Plain from North Carolina to New Jersey (region 031), the Central Lowlands in Iowa, Missouri, and Nebraska (125), and in the Great Basin of Nevada, Utah, and California (221). No significant increases occurred in any region.

Long-term trends, 1959 to 1969.--Statistical analyses of the 1959-69 data revealed that significant ($P < 0.05$) downward trends in BYI's occurred in all management units and submanagement units, except in the combined nonhunting States of the Eastern Unit (appendix table A4). No statistical significance could be attached to the observed upward trend shown for the nonhunting States of the Eastern Management Unit.

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APPENDIX

Table A1.--Changes in population density indexes for breeding mourning doves,
1958-69

EASTERN MANAGEMENT UNIT - HUNTING STATES

State	Comparable routes	Average doves heard/route (weighted) $\frac{1}{2}$		Percent change $\frac{3}{4}$
		1968	1959	
Ala.	25	16.85	20.59	+22.2
Del.	0			
Fla.	16	5.82	6.02	+ 3.4
Ga.	21	18.12	19.78	+ 9.2
Ill.	13	32.50	26.68	-17.9
Ky.	16	26.42	26.37	- 0.2
La.	18	8.79	8.86	+ 0.8
Md.	8	12.47	11.91	- 4.5
Miss.	18	22.60	24.39	+ 7.9
N.C.	16	31.70	25.58	-19.3**
Pa.	14	10.69	11.55	+ 8.0
R.I. $\frac{2}{1}$	2	7.50	7.00	- 6.7
S.C.	16	30.07	30.58	+ 2.0
Tenn.	20	18.14	17.42	- 4.0
Va.	8	28.80	22.03	-23.3
W. Va.	5	3.01	3.42	+13.6
Subtotal	216	18.87	18.40	- 2.49

EASTERN MANAGEMENT UNIT - NONHUNTING STATES

Conn.	2	6.00	1.50	-75.0*
Ind.	9	31.79	30.62	- 3.7
Maine $\frac{2}{1}$	2	1.00	1.50	+50.0
Mass.	3	4.91	1.43	-70.9
Mich.	14	6.83	8.81	+29.0
N.H. $\frac{2}{1}$	3	4.33	4.00	- 7.6
N.J.	3	23.29	20.30	-12.8
N.Y.	12	8.28	7.12	-14.0
Ohio	10	26.88	30.46	+13.3
Vt. $\frac{2}{1}$	2	3.50	2.00	-42.9
Wis.	16	12.49	10.82	-13.4
Subtotal	76	15.58	15.64	+ 0.39
Eastern Unit Total	292	17.86	17.55	- 1.74

Table A1.--Changes in population density indexes for breeding mourning doves,
1968-69--continued

CENTRAL MANAGEMENT UNIT - HUNTING STATES

State	Comparable routes	Average doves heard/route (weighted) $\frac{1}{2}$		Percent change $\frac{3}{4}$
		1968	1969	
Ark.	8	27.89	31.05	+11.3
Colo.	9	10.06	14.39	+43.0
Kans.	15	55.81	61.85	+10.8
Mo.	13	38.74	24.97	-35.5***
N. Mex.	15	19.61	13.52	-31.1
Okla.	9	43.63	35.78	-18.0
Tex.	30	16.26	15.54	- 4.4
Subtotal	99	25.36	23.59	- 6.98

CENTRAL MANAGEMENT UNIT - NONHUNTING STATES

Iowa	9	35.77	30.17	-15.7
Minn.	8	14.19	7.44	-47.6**
Mont.	6	4.34	5.04	+16.1
Nebr.	17	45.72	45.63	- 0.2
N. Dak.	21	24.82	20.78	-16.3
S. Dak. $\frac{5}{2}$	10	50.20	45.94	- 8.5
Wyo.	6	2.78	5.18	+122.3
Subtotal	77	22.97	21.02	- 8.49
Central Unit Total	176	24.34	22.49	- 7.60

WESTERN MANAGEMENT UNIT - HUNTING STATES

Ariz.	32	34.01	38.50	+13.2
Calif.	48	11.75	11.34	- 3.5
Idaho	5	9.41	8.91	- 5.3
Nev.	8	11.14	8.56	-23.2
Oreg.	18	15.53	17.65	+13.3
Utah	10	15.04	10.57	-29.7
Wash.	17	7.96	8.44	+ 6.0
Western Unit Total	138	15.51	15.52	+ 0.05

Table A1.--Changes in population density indexes for breeding mourning doves,
1968-69--continued

United States	Comparable routes	Average doves heard/route (weighted) ^{1/}		Percent change ^{3/4/}
		1968	1969	
Hunting States	453	20.13	19.34	- 3.92
Nonhunting States	153	20.67	19.34	- 6.43
United States Total	606	20.29	19.34	- 4.68

^{1/} Except as noted, State and management unit indexes were obtained from comparable, randomized route data adjusted for variation in the land area of each physiographic region represented.

^{2/} State indexes obtained from comparable, non-randomized route data not weighted by physiographic region. State data not represented in the respective management unit means.

^{3/} Probability that the direction of the observed change was due to sampling error: *10 percent - **5 percent - ***1 percent.

^{4/} Percent change calculated using data carried to 3 decimal places, hence the apparent rounding error.

^{5/} South Dakota--hunting State in 1967 and 1968.

Table A2.--Trends in mourning dove breeding density indexes by State, 1959-1969

State	Weight factor ^{1/}	ADJUSTED AVERAGE Doves HEARD CALLING PER ROUTE ^{2/ 3/}										10-yr. (1959-68) Data			
		1959	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	Mean	Departure:1969	
EASTERN MANAGEMENT UNIT - HUNTING STATES															
Alabama	33.32	18.1	22.0	19.4	18.9	16.3	21.1	20.5	20.5	19.8	17.1	20.8	19.4	+ 7.6%	
Delaware	1.29	6.8	6.2	4.6	5.6	5.1	4.4	5.1	3.8	7.5	5.2	--	5.4	--	
Florida	35.82	8.6	10.1	9.4	11.4	9.8	11.2	10.5	9.4	9.1	7.6	7.8	9.7	-19.5	
Georgia	37.82	13.3	16.9	14.4	16.8	14.4	22.5	18.5	13.1	15.4	14.2	15.5	16.0	- 2.9	
Illinois	35.09	29.8	28.3	32.3	26.3	26.9	24.3	23.5	27.0	27.9	27.0	22.1	27.3	-19.0	
Kentucky	26.08	28.8	29.8	28.2	28.6	27.0	30.4	32.5	35.3	29.9	26.2	26.1	29.7	-12.0	
Louisiana	31.14	17.9	19.3	17.8	14.2	16.6	13.6	11.6	7.7	8.9	7.4	7.5	13.5	-44.4	
Maryland	6.55	18.0	15.6	14.4	15.8	16.1	16.1	16.0	15.2	20.1	17.5	16.7	16.5	+ 1.6	
Mississippi	30.63	37.7	37.8	33.2	35.4	30.5	35.1	36.8	33.6	27.7	26.4	28.5	33.4	-14.7	
North Carolina	22.51	20.3	19.7	17.3	19.0	21.0	21.9	24.8	26.4	21.4	22.7	18.4	21.4	-14.4	
Pennsylvania	29.01	10.7	9.5	9.9	8.2	5.6	7.2	7.4	8.7	11.9	9.0	9.8	8.8	+10.9	
Rhode Island ^{4/}	--	7.0	4.0	5.0	5.5	5.5	8.9	5.9	4.2	5.3	8.8	8.2	6.0	+37.4	
South Carolina	19.99	24.4	25.8	25.5	23.0	23.0	24.1	35.3	34.4	34.2	33.1	33.8	23.3	+19.4	
Tennessee	27.07	35.1	35.6	30.2	34.8	29.2	23.1	30.4	30.4	22.3	23.5	22.5	30.0	-24.8	
Virginia	26.05	30.6	30.6	28.7	24.8	25.2	29.0	24.0	29.1	23.6	31.8	24.4	27.7	-12.1	
West Virginia	15.41	7.7	20.1	21.0	44.0	18.5	23.4	22.6	9.8	5.0	5.0	5.7	17.7	-68.1	
SUB-TOT./AVERAGE	377.78	21.6	23.0	21.5	22.2	19.8	21.9	22.0	21.2	19.6	18.9	18.4	21.2	-13.2%	
EASTERN MANAGEMENT UNIT - NONHUNTING STATES															
Connecticut	3.23	4.1	6.5	3.5	3.5	3.0	2.4	1.9	2.9	4.5	4.9	1.2	3.7	-67.0%	
Indiana	23.35	33.2	25.1	28.3	23.4	25.8	27.7	20.2	37.2	38.6	41.7	40.2	30.2	+33.0	
Maine ^{4/}	--	1.5	3.0	3.0	3.0	1.3	0.0	0.3	1.3	0.0	2.0	1.5	1.4	+ 4.2	
Massachusetts	5.31	7.4	10.6	6.9	9.0	5.2	6.7	7.7	11.0	14.5	4.9	1.4	3.4	-83.0	
Michigan	37.13	15.5	14.0	14.8	11.8	17.4	13.2	8.0	12.3	11.9	9.1	11.8	12.8	- 8.0	
New Hampshire ^{4/}	--	4.3	6.8	4.6	3.4	3.1	6.3	10.6	7.5	5.0	4.4	4.0	5.6	-27.8	
New Jersey	4.91	32.7	32.7	29.0	28.8	29.5	30.4	25.7	24.2	20.1	30.0	26.3	28.3	- 7.0	
New York	30.49	5.8	8.8	7.2	8.3	7.8	7.0	7.1	7.9	7.8	6.8	5.8	7.4	-21.5	
Ohio	26.42	16.9	14.8	17.9	21.4	17.5	16.8	19.1	26.3	25.5	27.0	30.6	20.3	+50.6	
Vermont ^{4/}	--	1.0	8.0	0.0	2.0	2.0	2.0	1.0	6.0	5.0	3.5	2.0	3.0	-34.5	
Wisconsin	35.07	16.1	18.3	18.1	12.7	14.1	15.2	16.1	11.1	13.5	11.4	9.8	14.7	-32.9	
SUB-TOT./AVERAGE	165.97	16.6	16.0	16.4	14.7	16.0	15.2	13.4	17.1	17.6	17.0	17.1	16.0	+ 7.1%	
EAST. MGMT. UNIT															
TOTAL/AVERAGE	544.75	20.1	20.8	20.0	19.9	18.6	19.8	19.4	20.0	19.0	18.3	18.0	19.6	- 8.1%	

Table A2.--Trends in mourning dove breeding density indexes by State, 1959-1959--continued

State	Weight factor ^{1/}	ADJUSTED AVERAGE Doves HEARD CALLING PER ROUTE ^{2/ 3/}										10-yr. (1959-63) Data		
		1959	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	Mean	Departure: 1969
CENTRAL MANAGEMENT UNIT - HUNTING STATES														
Arkansas	34.37	18.6	17.4	19.0	10.5	16.0	16.8	14.8	16.5	20.7	20.0	22.3	17.0	+30.7 %
Colorado	67.18	19.6	28.8	13.8	13.8	11.0	13.1	11.5	14.8	16.1	13.7	19.7	15.6	+25.9
Kansas	52.43	44.2	54.4	55.2	56.2	49.8	53.1	48.2	51.8	60.3	59.2	65.6	53.2	+23.2
Missouri	45.10	47.1	50.2	45.2	42.7	36.7	40.2	36.0	39.3	36.6	39.1	25.2	41.3	-38.9
New Mexico	77.98	18.7	32.5	21.8	19.2	18.1	20.6	19.3	28.4	8.5	16.0	11.0	20.3	-45.7
Oklahoma	44.40	50.0	40.9	41.6	35.4	39.9	37.7	34.6	29.3	37.9	41.3	33.9	39.0	-13.1
Texas	170.03	21.8	22.9	18.6	19.4	17.7	17.4	16.4	17.8	16.8	15.8	15.1	18.5	-13.0
SUB-TOT./AVERAGE	491.49	28.0	32.3	26.9	25.6	23.9	25.0	22.9	25.6	24.0	24.9	23.6	25.9	- 8.9%
CENTRAL MANAGEMENT UNIT - NONHUNTING STATES														
Iowa	36.15	38.3	30.6	38.3	37.1	33.5	34.9	29.0	33.2	34.1	30.7	25.8	34.0	-23.9%
Minnesota	54.09	15.4	15.0	19.3	15.9	16.2	20.5	18.6	18.7	16.7	19.1	10.0	17.5	-43.0
Montana	94.47	9.2	18.3	15.7	10.4	15.1	15.4	15.7	17.1	18.7	5.7	6.6	14.1	-53.4
Nebraska	49.69	98.0	109.3	88.6	69.9	58.7	66.1	55.6	48.5	40.0	47.8	47.7	58.2	-30.0
North Dakota	45.54	20.0	21.2	22.3	20.1	20.0	20.2	23.4	20.7	20.7	24.2	20.2	21.3	- 4.9
South Dakota ^{5/}	49.20	64.2	40.2	48.5	37.4	40.6	39.0	35.1	45.3	28.2	32.9	30.1	41.1	-26.9
Wyoming	62.33	11.0	10.0	11.8	10.8	12.7	9.8	12.1	15.9	13.0	9.3	20.6	11.6	+77.3
SUB-TOT./AVERAGE	391.47	32.5	32.3	31.8	25.8	25.9	27.0	25.2	26.6	23.1	21.3	20.8	27.1	-23.2%
CENT. MGMT. UNIT														
TOTAL/AVERAGE	882.96	30.0	32.3	29.1	25.7	24.8	25.9	23.9	25.1	23.6	23.3	22.4	26.5	-15.4%

Table A2.--Trends in mourning dove breeding density indexes by State, 1959-1969--continued

State	Weight factor ^{1/}	1959	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	10-yr. (1959-68) Mean	Data Departure: 1969
WESTERN MANAGEMENT UNIT														
Arizona	72.65	24.4	19.1	34.3	23.8	22.7	27.6	26.6	30.4	27.6	23.8	27.0	26.0	+ 3.7%
California	101.71	33.5	36.2	26.0	29.2	29.2	32.0	21.6	17.3	14.2	12.0	11.5	25.1	-54.1
Idaho	54.37	17.7	20.4	18.0	18.3	18.3	20.6	19.4	18.6	17.8	13.0	17.0	18.7	- 9.1
Nevada	71.27	2.6	1.9	2.3	1.2	1.8	2.9	2.7	4.0	4.4	8.2	6.3	3.2	+96.4
Oregon	62.27	20.9	19.2	21.2	18.2	16.8	18.1	14.1	14.0	12.9	13.2	14.9	16.9	-11.6
Utah	53.34	22.9	18.6	14.8	13.6	13.4	12.9	13.7	14.8	22.2	12.3	8.6	15.9	-45.9
Washington	43.87	15.2	10.5	9.2	11.0	9.8	13.2	13.1	13.3	11.4	10.5	11.1	11.7	- 5.2
WESTERN MGMT. UNIT														
TOTAL/AVERAGE	459.48	21.7	19.5	19.1	17.7	17.3	19.5	16.4	16.3	15.7	14.0	13.9	17.6	-21.3%
TOTAL HUNTING STATES														
	1,328.75	23.7	25.2	22.7	21.9	20.4	22.2	20.4	21.2	19.9	19.4	13.8	21.7	-13.6%
TOTAL NONHUNTING STATES														
	558.44	27.7	21.4	27.2	22.5	22.9	23.5	21.7	23.7	21.4	20.0	19.7	23.8	-17.1%
U.S. TOTAL/AVERAGE														
	1,837.19	24.9	25.9	24.0	22.0	21.2	22.6	20.8	21.9	20.3	19.6	19.0	22.3	-14.7%

^{1/} Assigned State land-area value.

^{2/} From a base year, average doves heard calling per route for each State has been adjusted annually according to the percent change from the preceding year in counts on comparable routes. Except as noted, percent changes between years have been based upon unweighted, randomized data for the period 1959 to 1965 inclusive. Annual percent changes since 1966 have been derived from randomized data weighted by physiographic regions within States. The base year index (mean of 1966 and 1967) was changed from previous reports in 1967 (Ruos and MacDonald, 1968).

^{3/} Percent departures calculated from data carried to three decimal places; hence, apparent rounding errors.

Unit and subunit averages calculated by weighting individual State indexes; hence, change in unit long-term trend index may not indicate precisely the same percent change as the 2-year comparison (table A1).

^{4/} Indexes for Maine, New Hampshire, Rhode Island, and Vermont represent unweighted and unrandomized data and have not been included in the "weighted means."

^{5/} South Dakota--hunting State in 1967 and 1968.

Table A3.--Ranking of 1968 and 1959 breeding population data by physiographic region within management unit

Rank	United States ^{1/}					Eastern Management Unit ^{1/}				
	1968			1969		1968			1969	
	Reg.	BDI 2/	Cum. % of Unit Area	Reg.	BDI 2/	Reg.	BDI 2/	Cum. % of Unit Area	Reg.	BDI 2/
1	205	62.0	0.4	205	89.0	032	50.5	3.2	032	46.8
2	135	57.4	1.7	135	62.8	111	37.0	8.1	111	34.2
3	216	52.0	2.1	215	53.2	042	36.1	8.4	124	32.9
4	032	50.5	3.0	032	46.8	124	35.0	19.3	042	31.7
5	125	50.4	6.2	130	45.5	031	23.7	22.0	034	21.5
6	130	49.5	7.0	125	37.4	041	21.4	29.6	112	20.8
7	126	39.2	11.1	111	34.2	034	18.7	41.9	062	19.4
8	111	37.0	12.5	126	34.0	035	18.2	45.8	031	18.1
9	042	36.1	12.6	131	33.2	062	18.1	48.9	035	17.0
10	138	35.2	13.7	124	32.9	123	17.5	51.1	041	16.9
11	141	35.0	15.2	042	31.7	113	14.5	51.5	061	16.5
12	124	35.0	18.4	222	30.2	061	14.2	54.9	121	15.6
13	222	34.1	20.3	141	29.0	112	14.2	56.1	037	14.7
14	122	31.8	24.0	139	25.0	121	12.9	65.1	123	13.5
15	131	28.4	25.3	122	24.6	081	11.4	70.3	113	12.5
16	246	24.1	26.4	035	24.2	052	10.4	71.0	086	9.8

^{1/} Excludes Maine, New Hampshire, Rhode Island, and Vermont.

^{2/} Mean doves heard calling per route.

^{3/} Regional Breeding Population Index ÷ Unit Breeding Population Index.

Unshaded area shows those physiographic regions represented in the High Density Population Area.

Table A3.--Ranking of 1968 and 1969 breeding population data by physiographic region within management unit--
continued

Rank	Central Management Unit					Western Management Unit										
	1968					1968										
	1968 Reg. BDI	2/ Area	Cum. % of Unit Pop. 3/	1969 BDI	2/ Area	Cum. % of Unit Pop. 3/	1968 Reg. BDI	2/ Area	Cum. % of Unit Pop. 3/	1969 BDI	2/ Area	Cum. % of Unit Pop. 3/				
1	135	57.4	2.9	5.9	135	62.8	2.9	8.1	205	62.0	1.4	5.8	205	89.0	1.4	8.3
2	216	52.0	3.8	8.3	130	45.5	4.7	11.7	222	34.1	9.3	23.1	215	53.2	4.6	19.1
3	125	50.4	10.7	23.0	125	37.4	11.6	23.1	224	31.1	14.9	34.4	224	30.2	10.2	30.1
4	130	49.5	12.5	26.6	126	34.0	20.3	35.3	245	24.1	19.5	41.5	222	30.2	18.1	45.4
5	126	39.2	21.2	40.7	131	33.2	23.1	40.4	212	22.0	21.9	43.5	212	24.0	19.5	47.6
6	138	35.2	23.6	44.2	035	32.9	25.1	43.4	214	19.2	23.7	47.0	246	21.8	24.1	54.0
7	141	35.0	26.8	48.8	141	29.0	28.3	47.5	203	18.2	28.2	52.3	203	19.2	28.6	59.6
8	122	31.8	34.7	59.2	139	25.0	31.0	50.5	215	18.2	31.4	56.0	214	18.5	31.4	62.9
9	035	29.0	36.7	61.6	122	24.5	38.9	59.2	223	17.0	32.3	57.0	223	18.0	32.3	64.0
10	131	28.4	39.5	54.9	134	23.3	49.9	70.6	245	16.3	35.3	60.2	245	16.5	35.3	67.2
11	134	23.7	50.5	75.6	216	23.0	50.8	71.5	204	16.0	37.7	62.6	231	16.0	37.2	69.1
12	132	21.8	60.5	84.5	212	22.0	51.4	72.1	221	13.3	63.7	84.9	204	11.0	39.6	70.8
13	036	19.7	69.7	91.9	132	20.0	61.4	81.0	231	12.8	65.6	86.4	221	9.8	65.6	87.2
14	136	12.3	71.7	92.9	036	19.2	70.6	88.9	201	10.5	71.9	90.7	201	8.6	71.9	90.7
15	224	11.8	75.6	94.8	136	19.0	72.6	90.6	234	9.6	75.7	93.1	234	8.2	75.7	92.7
16	139	11.0	78.3	95.0	170	15.5	75.6	92.6	202	6.8	75.9	93.6	213	7.8	78.6	94.1

2/ Mean doves heard calling per route.

3/ Regional Breeding Population Index \div Unit Breeding Population Index.

Unshaded area shows those physiographic regions represented in the High Density Population Area.

Table A4.--Linear regression analysis of mourning dove call-count data, 1959-1969

Management unit	Regression Values (BDI)				Mean Annual Change 1959-1969		Significance (Probability that a trend exists)
	Change: 1959, 1969		Percent		Number	Percent	
	1959	1969	Number	Percent			
Eastern							
Hunt States	22.64	19.20	-3.44	-15.2	-0.34	-1.6	p .99
Nonhunt States	15.54	16.66	+1.12	+ 7.2	+0.11	+0.7	*
Total	20.47	18.42	-2.05	-10.0	-0.20	-1.0	p .99
Central							
Hunt States	28.49	22.91	-5.58	-19.6	-0.56	-2.2	p .95
Nonhunt States	32.38	20.77	-11.61	-35.9	-1.16	-4.3	p .99
Total	30.22	21.98	-8.24	-27.3	-0.82	-3.1	p .99
Western							
Total	20.46	14.10	-6.36	-31.1	-0.64	-3.6	p .99
United States							
Hunt States	24.05	18.82	-5.23	-21.7	-0.52	-2.4	p .99
Nonhunt States	27.33	19.53	-7.80	-28.5	-0.78	-3.3	p .99
Total	25.04	19.00	-6.04	-24.1	-0.60	-2.7	p .99

*Not significant ($p < .95$)

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